ESTABLISHED 1959

3143 Yellowstone Blvd., Houston, Texas 77054
Tel: (713) 748-3717 Fax: (713) 748-3748

Date: November 7, 2014
ATL Job No: G14-216

City of Houston Department of Public Works and Engineering
Engineering and Construction Division
Geo-Environmental Services Branch
611 Walker, 14th Floor
Houston, Texas 77002

Attention: Mr. Hasnain Jaffri, P.E.

Reference: Additional Geotechnical Investigation
Proposed Wirt Road Drainage and Paving Improvements
Outline Agreement No. 4600010674, Ordinance No, 2011-0081
City of Houston, Texas

Dear Mr. Jaffri:

Per your request, Associated Testing Laboratories, Inc. (ATL) has conduct pavement coring and additional drilling, soil sampling and laboratory testing presented in the table below. The objective is to provide supplemental soils and groundwater information for a previously conducted geotechnical investigation.

Boring No.	Depth, ft	Augering	Sampling	Remarks
B-1A	35	0-25	25-35	Completed
B-4A	35	0-25	25-35	Completed
B-9A	35	0-20	20-35	Completed
B-10A	45	0-30	30-45	*Drilled to 20'; lost drilling fluid circulation; moved to 10B
B-10B	45	0-30	30-45	Completed
B-11A	45	0-30	30-45	Completed
Drilled Footage		**150**	**65**	

The approximate locations of the additional borings drilled by ATL is shown in the enclosed Plan of Borings.

At Boring B-1A: The existing concrete pavement is about 7 inches thick. The boring was augered to a depth of 25 feet below the existing grade. Soils below the pavement consist of Sandy Lean Clays (CL) and Fat Clays (CH) to the bottom of the auger depth at 25 feet.

Soil sampling was conducted at 2-ft intervals from 25 to 35 feet. Soils from 25 to 29 feet consist of very stiff Fat Clays (CH) of very high plasticity. From 29 feet to the bottom of boring at 35 feet was a stratum of stiff to hard, medium to moderately high plasticity Sandy Lean Clays (CL).

Groundwater was encountered at a depth of about 25 feet during drilling, and was measured at depth of about 17 feet at the end of drilling.

Hydrocarbon-like odor was noted in the samples up to a depth of 29 feet, and light hydrocarbon-like odor was noted in the soil samples from 29 to the bottom of boring at 35 feet.

At Boring B-4A: The existing pavement consists of about 3 inches of asphaltic concrete. The boring was augered to a depth of 25 feet below the existing grade. Soils below the pavement consist of Sandy Lean Clays (CL) and Fat Clays (CH) to the bottom of the auger depth at 25 feet.

Soil sampling was conducted at 2-ft intervals from 25 to 35 feet. Soils from 25 to 31 feet consist of stiff to very stiff Fat Clays (CH) of high to very high plasticity. From 31 feet to the bottom of boring at 35 feet was a stratum of stiff to very stiff, medium plasticity Sandy Lean Clays (CL).

Groundwater was encountered at a depth of about 25 feet during drilling, and was measured at depth of about 17 feet at the end of drilling.

At Boring B-9A: The existing pavement consists of about 7 inches of asphaltic concrete. The boring was augered to a depth of 20 feet below the existing grade. Soils below the pavement consist of Sandy Lean Clays (CL) to the bottom of the auger depth at 20 feet.

Soil sampling was conducted at 2-ft intervals from 20 to 35 feet. Soils from 20 to 26 feet consist of loose to medium dense Silty Sands (SM). From 26 feet to 28 feet, a stratum of very stiff, medium plasticity Sandy Lean Clays (CL) exists. Below 28 feet, a stratum of medium dense Silty Sands (SM) exists to the bottom of boring at 35 feet.

Groundwater was encountered at a depth of about 20 feet during drilling, and was measured at depth of about 14 feet at the end of drilling.

At Boring B-10A: The existing pavement consists of about 8 inches of concrete. The boring was augered to a depth of 20 feet below the existing grade. Soils below the pavement consist of Sandy Lean Clays (CL) to the bottom of the auger depth at 20 feet.

Groundwater was encountered at a depth of about 19 feet during drilling, and was measured at depth of about 17.5 feet after about 15 minutes.

Loss of circulation of drilling fluid occurred at a depth of 20 feet, and the drilling was terminated.

At Boring B-10B: The existing pavement consists of about 8 inches of concrete. The boring was augered to a depth of 30 feet below the existing grade. Soils below the pavement consist of Sandy Lean Clays (CL) and Fat Clays (CH) to the bottom of the auger depth at 30 feet.

Soil sampling was conducted at 2-ft intervals from 30 to 45 feet. Soils from 30 to the bottom of boring at 45 feet consist of stiff to hard, very high plasticity Fat Clays (CH).

Groundwater was encountered at a depth of about 27 feet during drilling, and was measured at depth of about 26 feet at the end of drilling.

At Boring B-11A: The existing pavement consists of about 8 inches of concrete. The boring was augered to a depth of 30 feet below the existing grade. Soils below the pavement consist of Sandy Lean Clays (CL) to a depth of about 20 feet, followed by a stratum of Silty Sands (SM) to the bottom of the auger depth at 30 feet.

Soil sampling was conducted at 2-ft intervals from 30 to 45 feet. Soils from 30 to a depth of about 42 feet consist of dense to very dense Poorly Graded Sands (SP-SM). A stratum of dense Clayey-Silty Sands (SC-SM) exists between depths of 42 and 44 feet, followed by a stratum of Lean Clays with Sand (CL) to the bottom of boring at 45 feet.

Groundwater was encountered at a depth of about 19 feet during drilling, and was measured at depth of about 18 feet at the end of drilling.

It has been a pleasure working with you on this project. Should you have any questions concerning this project work, please call us at (713) 748-3717.

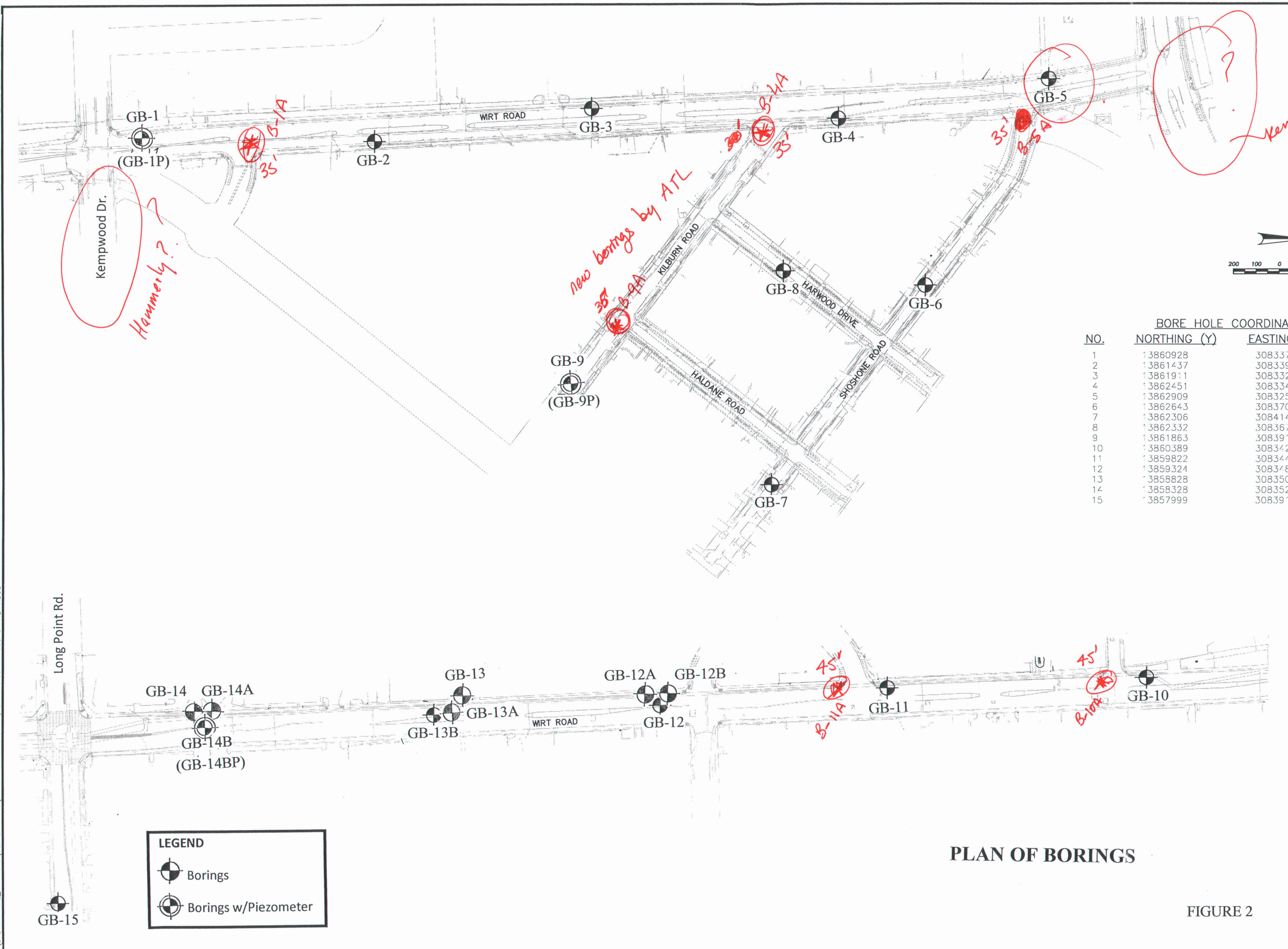
Sincerely,
ASSOCIATED TESTING LABORATORIES, INC.

11/7/14

Peng Sia Tang; P.E.
Manager, Geotechnical Services

Attachment: Plan of Borings
Logs of Borings B-1A, B-4A, B-10A, B-10B and B-11A

M:\3757.PHFINAL_WIRTROAD\GEOTECHNICAL\BORELAYOUT.DWG Jul. 8, 2014-3:38 PM JOSHUA NETARDUS



BORE HOLE COORDINATE TABLE

NO.	NORTHING (Y)	EASTING (X)	ELEVATION (Z)
1	13860928	3083375	75.70
2	13861437	3083391	75.76
3	13861911	3083320	76.19
4	13862451	3083343	75.90
5	13862909	3083257	74.77
6	13862643	3083707	77.49
7	13862306	3084143	77.30
8	13862332	3083675	77.51
9	13861863	3083916	77.32
10	13860389	3083424	75.64
11	13859822	3083446	73.97
12	13859324	3083484	74.11
13	13858828	3083503	70.31
14	13858328	3083523	69.78
15	13857999	3083912	68.78

PLAN OF BORINGS

FIGURE 2

r.g.miller engineers
since 1966
16340 Park Ten Place Suite 350
Houston, Texas 77084
(713) 461-9600
Texas Firm Registration No. F-487

SURVEYED BY: KUO
FB NO.

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

WIRT ROAD DRAINAGE AND PAVING SUB-PROJECT II

BORE LAYOUT EXHIBIT

WBS NO.
M-000287-0002-3
DRAWING SCALE
1"=200'
CITY OF HOUSTON PM
ANA TREJO
SHEET NO. OF

Associated Testing Laboratories, Inc.
3143 Yellowstone Blvd
Houston, Texas-77054

LOG OF BORING B-1A

PROJECT: Additional Geo Investigation For Wirt Rd. Drainage & Paving Improvements WBS No.: M-000287-0002-3

PROJECT NO.: G14-216 BORING TYPE: Auger

DATE 10-16-14

SURFACE ELEVATION

LOCATION

On Wirt Road

Northing:

Easting:

MATERIAL DESCRIPTION

DEPTH (ft.)	USC	Material Description	POCKET PENETROMETER(P,tsf)	BLOW COUNT (N, Blows/Foot)	DRY DENSITY (pcf)	Undrained Shear STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	PASSING #200 SIEVE (%)	ESTIMATED ANGLE OF INTERNAL FRICTION (°), OTHER TESTS & REMARKS
0		7" Concrete												
		(Augered to 25')												
		Sandy Lean Clay (CL) and Fat Clay (CH), with hydrocarbon-like odor												
5		..dark gray to 4'												
		.. light gray & tan below 4'												
		.. with calcareous nodules below 8'												
10	CL CH													
15		.. reddish brown below 14'												
20														
25		Fat Clay (CH), very stiff, high plasticity, reddish brown, with hydrocarbon-like odor	4.0		104			0	23	65	21	44	99	
	CH	.. hard, with calcareous nodules below 27' (Slickensided)	4.5		102			0	26	73	22	51	99	
30		Sandy Lean Clay (CL), stiff to hard, high plasticity, reddish brown, with light hydrocarbon-like odor		11					27	38	17	21		
	CL			18					23	26	15	11		
		.. stiff below 33'		42					25	42	18	24		
35														

N (blows/ft) 20 40 60 80; Q_u (tsf) 1.0 2.0 3.0 4.0; DD (pcf) 90 100 110 120; P (tsf) 1.0 2.0 3.0 4.0

Natural Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit; 20 40 60 80

Water Level Initial: ▽ After Drilling: ▼ 24 Hrs: ▼

Water Observations: Initial Water Level: 25', After Drilling: 17'

Sample Key: ☒ SPT ☐ Shelby Tube ▤ Disturbed

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (psf)
Q_u - Undrained Shear Strength (tsf)
DD - Dry Density (pcf)

Notes:
Augered dry to 35'; Drilled By: Soltek, LLC, Logged BY: PV, Checked By: Jitu/pankaj QC/QA By: PST

Associated Testing Laboratories, Inc.
3143 Yellowstone Blvd
Houston, Texas-77054

LOG OF BORING B-4A

DATE 10-16-14

SURFACE ELEVATION

PROJECT: Additional Geo Investigation For Wirt Rd. Drainage & Paving Improvements WBS No.: M-000287-0002-3

PROJECT NO.: G14-216 BORING TYPE: Auger

LOCATION

On Wirt Road

Northing:

Easting:

DEPTH (ft.)	SAMPLES	USC	WATER LEVEL	MATERIAL DESCRIPTION	POCKET PENETROMETER(P,tsf)	BLOW COUNT (N, Blows/Foot)	DRY DENSITY (pcf)	Undrained Shear STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	PASSING #200 SIEVE (%)	ESTIMATED ANGLE OF INTERNAL FRICTION (°), OTHER TESTS & REMARKS
0				3" Asphaltic Concrete												
				(Augered to 25')												
		SM		Fill: Silty Sand (SM), tan												
5				Sandy Lean Clay (CL) and Fat Clay (CH), light gray & tan												
10																
15		CL CH	▼	.. reddish brown, with calcareous nodules below 16'												
20																
25			▽	Fat Clay (CH), very stiff, high plasticity, reddish brown	4.5		111			0	22	68	22	46	99	
		CH		.. with calcareous nodules below 27'	3.5		109			0	22					
30				.. stiff below 29'	2.0		104			0	23	52	19	33	99	
				Sandy Lean Clay (CL), stiff, medium plasticity, reddish brown	2.0		105			0	20					
		CL		.. very stiff below 33'	3.5		109			0	21	30	16	14		
35																

Natural Moisture Content and Atterberg Limits: Plastic Limit, Moisture Content, Liquid Limit (20 40 60 80)

N (blows/ft) 20 40 60 80; Q_u (tsf) 1.0 2.0 3.0 4.0; DD (pcf) 90 100 110 120; P (tsf) 1.0 2.0 3.0 4.0

Water Level Initial: ▽ After Drilling: ▼ 24 Hrs: ▼

Water Observations: Initial Water Level: 25', After Drilling: 17'

Sample Key: ☒ SPT ☐ Shelby Tube ☐ Disturbed

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (psf)
Q_u - Undrained Shear Strength (tsf)
DD - Dry Density (pcf)

Notes:
Augered dry to 35'; Drilled By: Soltek, LLC, Logged BY: PV, Checked By: Jitu/pankaj QC/QA By: PST

Associated Testing Laboratories, Inc.
3143 Yellowstone Blvd
Houston, Texas-77054

LOG OF BORING B-9A

DATE 10-17-14

SURFACE ELEVATION

PROJECT: Additional Geo Investigation For Wirt Rd. Drainage & Paving Improvements WBS No.: M-000287-0002-3

PROJECT NO.: G14-216 BORING TYPE: Auger

LOCATION

On Kilburn Road

Northing:

Easting:

DEPTH (ft.)	SAMPLES	USC	WATER LEVEL	MATERIAL DESCRIPTION	POCKET PENETROMETER(P,tsf)	BLOW COUNT (N, Blows/Foot)	DRY DENSITY (pcf)	Undrained Shear STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	PASSING #200 SIEVE (%)	ESTIMATED ANGLE OF INTERNAL FRICTION (°), OTHER TESTS & REMARKS
0				7" Asphalt												
				(Augered to 20')												
				Sandy Lean Clay (CL), dark gray												
5				.. gray & tan below 6'												
				.. light gray & tan below 8'												
10		CL														
15																
20				Silty Sand (SM), loose, non plastic, light gray & tan		10					22				11	
		SM		.. medium dense below 22'		20					18					
25						12					20				37	
		CL		Sandy Lean Clay (CL), very stiff, medium plasticity, light gray & tan		24					23	36	17	19		
				Silty Sand (SM), medium dense, non plastic, light gray & tan		18					24				7	
30		SM				16					24					
						18					26				8	
35						25					25					

N (blows/ft) 20 40 60 80

Q_u (tsf) 1.0 2.0 3.0 4.0

DD (pcf) 90 100 110 120

P (tsf) 1.0 2.0 3.0 4.0

Natural Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit; 20 40 60 80

Water Level Initial: ▽ After Drilling: ▼ 24 Hrs: ▼

Water Observations: Initial Water Level: 20', After Drilling: 14'

Sample Key: ☒ SPT ☐ Shelby Tube ☐ Disturbed

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (psf)
Q_u - Undrained Shear Strength (tsf)
DD - Dry Density (pcf)

Notes:
Augered dry to 20'; wash boring below 20' ; Drilled By: Soltek, LLC, Logged BY: PV, Checked By: Jitu/pankaj QC/QA By: PST

Project/Job #: CK-216 | Boring #: B-10A

Drilling Date: 10/16/14 | Total Depth: 45'

Sample Depth	Sample Type	Penetrometer/ Blow Counts	Color	MATERIAL MINOR	MATERIAL MAJ.	Material Description/Characteristics
						Concrete 8" 5' From Curb
			GR		SA	
2			T/LT	SA	cc	w/CALC
4			T/LT	SA	cc	w/CALC
6			T/LT	SA	cc	w/CALC Augered to 20'
8			T/LT	SA	cc	w/CALC
10			T/LT	SA	cc	w/CALC
12			T/LT	SA	cc	
14			T/LT	SA	cc	
16			T/LT	SA	cc	w/CALC
18			T/LT	SA	cc	w/CALC
20			T/LT	SA	cc	w/CALC water @ 19'
22						Refusal to water loss No water return
24 25						
26						
28						
30						

Initial Water: 19'

Final Water Reading: 17'6"

Cave in Depth:

Comments:

5min / 18'7"

10min / 18'

15min / 17'6"

Auger 0-30 sample 30-45

Associated Testing Laboratories, Inc.
3143 Yellowstone Blvd
Houston, Texas-77054

LOG OF BORING B-10B

DATE 10-27-14

PROJECT: Additional Geo Investigation For Wirt Rd. Drainage & Paving Improvements WBS No.: M-000287-0002-3

SURFACE ELEVATION

PROJECT NO.: G14-216 BORING TYPE: Auger

LOCATION

On Wirt Road

Northing:

Easting:

DEPTH (ft.)	USC	MATERIAL DESCRIPTION	POCKET PENETROMETER(P,tsf)	BLOW COUNT (N, Blows/Foot)	DRY DENSITY (pcf)	Undrained Shear STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	PASSING #200 SIEVE (%)	ESTIMATED ANGLE OF INTERNAL FRICTION (°), OTHER TESTS & REMARKS
0		8" Concrete												
		(Augered to 30') Sandy Lean Clay (CL) and Fat Clay (CH), light gray & tan												
5		..light gray and tan to 4'												
		.. with calcareous nodules below 4'												
		.. reddish brown below 6'												
10														
15	CL CH													
		.. with calcareous nodules below 18'												
20														
25														
30		Fat Clay (CH), hard, high plasticity, reddish brown	4.5						24	65	21	44	99	
		.. very stiff below 32'	4.0		100			0	26					
35			3.5						24					
	CH		4.0						25	65	21	44	99	
		.. stiff below 38'	2.0		94			0	30					
40		.. very stiff below 40'	3.5						31					
		.. with ferrous nodules below 42'	4.0						27	72	22	50	99	
45			3.5		100			0	26					

N (blows/ft) 20 40 60 80; Q_u (tsf) 1.0 2.0 3.0 4.0; DD (pcf) 90 100 110 120; P (tsf) 1.0 2.0 3.0 4.0

Natural Moisture Content and Atterberg Limits: Plastic Limit, Moisture Content, Liquid Limit; 20 40 60 80

Water Level Initial: ▽ After Drilling: ▼ 24 Hrs: ▼

Water Observations: Initial Water Level: 27', After Drilling: 26'

Sample Key: ☒ SPT ☐ Shelby Tube ▤ Disturbed

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (psf)
Q_u - Undrained Shear Strength (tsf)
DD - Dry Density (pcf)

Notes:
Augered dry to 45'; Drilled By: Soltek, LLC, Logged BY: PV, Checked By: Jitu/pankaj QC/QA By: PST

Associated Testing Laboratories, Inc.
3143 Yellowstone Blvd
Houston, Texas-77054

LOG OF BORING B-11A

DATE 10-17-14

PROJECT: Additional Geo Investigation For Wirt Rd. Drainage & Paving Improvements WBS No.: M-000287-0002-3

SURFACE ELEVATION

PROJECT NO.: G14-216 BORING TYPE: Auger

LOCATION

On Wirt Road

Northing:

Easting:

MATERIAL DESCRIPTION

DEPTH (ft.)	USC	MATERIAL DESCRIPTION	BLOW COUNT (N, Blows/Foot)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LL	PL	PI	PASSING #200 SIEVE (%)	ESTIMATED ANGLE OF INTERNAL FRICTION (°), OTHER TESTS & REMARKS
0		8" Concrete							
		(Auger to 30')							
		Sandy Lean Clay (CL), light gray & tan							
5		.. with calcareous nodules below 4'							
10	CL								
15									
20		Silty Sand (SM), light gray & tan (wet)							
25	SM	.. reddish brown below 26' (wet)							
30		Poorly Graded Sand (SP-SM), dense, non plastic, light gray & tan	50	20					
			53	21				9	
35	SP SM	.. very dense below 34'		19					50 Blows / 5 inch
				21				7	50 Blows / 3 inch
40				20					50 Blows / 5 inch
		.. dense below 40'	40	21				7	
	CL ML	Clayey Silty Sand (SC-SM), dense, non plastic, reddish brown	45	24	19	14	5	24	
45	CL	Lean Clay With Sand (CL), very stiff, high plasticity, reddish brown	21	27	47	18	29	83	

POCKET PENETROMETER(P,tsf)

N (blows/ft): 20 40 60 80

Q_u (tsf): 1.0 2.0 3.0 4.0

DD (pcf): 90 100 110 120

P (tsf): 1.0 2.0 3.0 4.0

DRY DENSITY (pcf)

Undrained Shear STRENGTH (tsf)

FAILURE STRAIN (%)

CONFINING PRESSURE (psi)

Natural Moisture Content and Atterberg Limits

Plastic Limit — Moisture Content — Liquid Limit

20 40 60 80

Water Level Initial: ▽ After Drilling: ▼ 24 Hrs: ▼

Water Observations: Initial Water Level: 19', After Drilling: 18'

Sample Key: ☒ SPT ☐ Shelby Tube ☐ Disturbed

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (psf)
Q_u - Undrained Shear Strength (tsf)
DD - Dry Density (pcf)

Notes:
Augered dry to 20'; wash boring below 20' ; Drilled By: Soltek, LLC, Logged BY: PV, Checked By: Jitu/pankaj QC/QA By: PST